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## **FROM TSARIST EMPIRE TO INDEPENDENT UKRAINE: WATER MANAGEMENT IN DONBASS AND CRIMEA, AN ECONOMIC, SOCIAL, AND POLITICAL ISSUE**

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The peninsula of Crimea and the Ukrainian part of the Donets basin (the Donbass, politically defined as the Donetsk and Luhansk Oblasts) have been the object of economic, political, and social challenges met by the Ukrainian state since its independence in 1991. The critical issue of water resources and shortage in the context of the political and armed conflict between Russia and Ukraine since 2014 requires further attention and historical perspective. From the 19th century's early industrial developments to the post-soviet context, the question is to know what the consequences of past policies and water managements on modern Ukraine are.

Water scarcity: Firstly, the environmental context and resulting natural water resources of Donbass and Crimea must be kept in sight. The whole Donbass and two-thirds of northern Crimea are part of a large and flat steppe land (the Pontic steppe, extending both sides of the Perekop isthmus [Vasilenko, 2017; Kent, 2016]) which low annual rainfall (300-360 mm in Crimea, 511-529 mm in Donbass from 1991 to 2020 and 416-572 mm from 1901 to 2021 [Tcheboxarov and al., 2019; World Bank]) and low annual precipitation/evaporation ratio (0,3-0,5 in Crimea [Tcheboxarov and al., 2019]) are constitutive of a semi-arid climate. The latter is defined by a dry bioclimatic region marked by irregular and insufficient rainfall, as well as a steppe vegetation in a hot climate (Dictionaries of the Académie française and Larousse). Agricultural production is therefore severely impeded without irrigation, the latter being restricted due to the regional lack of water (Marchand, 1993).

Industrial and urban developments under the Russian empire (XIXth-XXth centuries): The foundation of iron foundries on the Luhan (Lugan) river (1795), where stands today's Luhansk, and in Kerch (1845) precedes the implantation by British engineer John James Hughes of Donbass' first full-cycle metallurgy plant in Iuzovka, today's Donetsk (1869) which was soon followed by a take-off in metal production. However, the waters carried by the Kalmius river soon prove insufficient (Friedgut, 1989). Although less documented, testimonies of the Allied landing in Yevpatoria in 1854 describe the Crimean economy in the XIXth century, the region being an important grain export hub at that time. Wheat is being sown in the neighboring steppe as this specific area is known to have had decent

water reserves compared to the rest of the peninsula, where water reserves were already an issue (De Damas, 1857, quoted by Kent, 2016). As the Russian tsarist defeat in the Crimean war (1854-1856) pushes for industrial and metallurgical modernization of the empire, the metallurgy-related forests depletion in the Urals also contributes to an industrial shift towards the Donets basin and its coal reserves (Josephson, 2013; Friedgut, 1989). As Iuzovka experiences dazzling urban and industrial growth (reaching 20'000 inhabitants in 1890 and 50'000 in 1910), the whole of its water resources is obviously depleted from the 1890's and at the turn of the XXth century (Friedgut, 1989). Throughout these early developments, water-shortage is a critical issue in the whole Donbass and a major factor of sanitary crisis and epidemics. The subsequent lack of elementary hygiene in cities thus triggers or aggravates cholera epidemics, such as the catastrophic 1892 outbreak (Friedgut, 1989).

Soviet socialist development throughout industrialization (1920's and 1930's): The Bolshevik revolution of 1917 and the foundation of the USSR in 1922 open a time of further economic developments by State's centralized-planned decisions in Moscow, only owner of the all-Union natural resources, including water. The ideological framework emphasizes the machinist modernity of industrialist society, its superiority on "antic nature" and the need to tame this latest for the interests of the new homo sovieticus (Rey, 1997 plus quoting Lemechev, 1991). In this context, the coal mining industry is directly subjected to the State administration in the perspective of the rapid industrialization of the whole USSR, the first vehicle of this development being heavy industries (Walther, 2019; Zimmer, 2006). In parallel, Soviet statistics report a 74,3% urban increase in the Donbass between 1924 and 1929, pressuring even more the available water resources at the start of the first Stalinian five-year plan (Liber, 1989). The water and sanitary problematics present in Donbass since the XIXth Century emerge again at this point, the summer of 1930 in Stalino (Donetsk) being marked by a quasi-total lack of water in the city bathhouses as well as bad living conditions and the outbreaks of typhoid fever and dysentery. On this same year, it is reported that 60% of all soviet Ukrainian anti-epidemics' funds are then allocated to the Donbass (Kuromiya, 1998). In Crimea, Agriculture reconstruction (formerly devastated by 1st World War and the former empire's civil war) results in the polyculture of cereals, fruits, and wine before their collectivization (Magosci, 1983, quoted by Kent, 2016). A major step is then taken to transform the peninsula in an important lung of soviet heavy industries, through the development of the Dzhankoi metallurgical plant and the Voikov electrical powerhouse (in the context of the GOELRO plan and Stalinian five-year plans [Kent, 2016]). Following the German Hitlerian invasion of 1941 and the reconquest of Crimea in 1944, the postwar developments in the peninsula will be tremendous, through the renewal of metallurgical and chemical industries, a heavy urbanization, but also a massive

development of agriculture and resorts (Kent, 2016). The water issue was soon to become critical in both Donbass and Crimea, necessitating water supply infrastructures, such projects being studied for Donbass as early as the 1930's (Karpenko and al., 1975).

Economic development, water depletion and subsequent water infrastructure projects (1945-1991): In this respect, some articles of the soviet journal Гидротехническое строительство (hydraulic engineering) (published from 1967 to 1975) provide valuable and unique contents on the context and issues of soviet-built canals in Donbass and Crimea for water supply between the 1950's and 1970's. This Soviet technical journal was the only State's periodical specialized in hydraulic and hydro-electrical engineering and use of water resources (Гидротехническое строительство). The first major infrastructure palliating the lack of water in Donbass is the Donets-Donbass canal, built between 1954 and 1958 and supplying the central and western industrial Donbass with "drinking" and "industrial" water from the Donets (Encyclopedia of Ukraine, 1984; Bronshtein and al., 1967). This canal being internal to the water resources of the Donets basin, its construction cannot prevent the general depletion of water in the area. Indeed, the Donbass is cited first among the most water-depleted regions of the whole USSR, along with Crimea in a 1967 report on the Soviet Union's water resources (Razin and al., 1967). Furthermore, the high concentration of industries and the underdeveloped purification facilities are then reported as the two major causes of water-depletion in Central and Eastern Donbass, thus leading to the building of the new Dnieper-Donbass canal, from 1969 (completed 1981), during the ongoing eighth five-year plan (Razin and al., 1967; The Encyclopedia of Ukraine, 1984). At this point, the Donbass' water resources were approaching simple depletion according to rated river flows up to 1970 while water needs for the region's economy and cities were estimated as surpassing the existing reserves in 1975 (Karpenko and al., 1975). Interestingly, various schemes were considered as early as 1965 to divert water from Don or Dnieper as well as combinations of both diversions (Karpenko and al., 1975). Regarding Crimea, the excavation of the new North Crimea canal is then motivated by the necessary supply of fresh water to meet the needs of irrigation, cities, and health resorts (Razin and al., 1967). Moreover, the industrial pollution of ground water resources is already mentioned in these sources (Razin and al., 1967), which is a new type of water-related challenge met by the soviet State as well as will be met by the post-soviet Ukrainian State. Consequently, we can observe that the soviet-era water developments implemented a lasting scheme of Dnieper-water resources, at the heart of Ukraine, supplying water-deficient peripheral regions, the Donbass and Crimea, which would manifest autonomist or secessionist tendencies after 1991.

Concluding remarks, Ukraine since 1991: In this post-soviet context, the consequences of past water management on independent Ukraine can firstly be

described as social and environmental (both Donbass and Crimea basins' population suffering high concentrations of industrial heavy metals in water, heavy pollution and discharges related to the lack or decay of the inherited purification systems, while various epidemics resurface [Nazarov and al., 2001; Mykhnenko and al., 2010]) but also economical (necessary investments being precluded by the severe economic crisis [Nazarov et al., 2001]) and political, due to the vulnerability of the population to water-shortage in these two regions of conflict in the XXIst century.

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